

OEM Sensor LG16-2000HC-D

Microfluidic Flow Sensor for Hydrocarbons

- Liquid flow rates up to 80 ml/min
- Calibrated for Isopropanol alcohol
- Totally non invasive
- Digital I²C interface



1 Introduction LG16

The LG16 Liquid Flow Sensor series enables fast, non invasive measurements of very low liquid flow rates below 80 ml/min. This product is especially suited for OEM volume applications requiring small sized components with high performance at low cost. Excellent chemical resistance and bio-compatibility are ensured: The flow path of the LG16 Liquid Flow Sensors is formed by a simple, straight glass capillary. This Swiss made, non invasive sensors are based on Sensirion's patented CMOSens[®] Technology (US Patent 6,813,944 B2). The fourth generation MEMS sensors combine a thermal high precision sensor element with amplification circuits and digital intelligence for linearization and temperature compensation on one single microchip – the products core element.

2 Sensing Performance

Table 1: Performance of LG16-2000HC-D
(all data for medium IPA, 23°C, 1 bar_{abs} unless otherwise noted)

Parameter	LG16-2000HC-D	
Maximum Flow Rate	80	ml/min
Repeatability single sample (3σ)	1.35	% of m.v.
Repeatability of integrated signal, 2 seconds (1σ)	0.6	% of m.v.
Accuracy (whichever error is greater)	10	% of m.v.
	0.37	% of full scale
Temperature Coefficient	0.35	(% m.v.) / K
Mounting Orientation Sensitivity	0.3	% of full scale
Flow Detection Response Time τ ₆₃	40	ms
Response Time On Power-Up	120	ms
Digital Sampling Rate, 16 bit	74	ms
Digital Sampling Rate, 9 bit	1	ms
Operating Temperature	+10...+50	°C
Ambient storage temperature	-20...+60	°C

3 Output Signals

The OEM flow sensor LG16 shows bi-directional, linear transfer characteristics. The product comes fully calibrated for Isopropanol. Digital communication between a master and the LG16 sensor runs via the standard I²C-interface. The physical interface consists of two bus lines, a data line (SDA) and a clock line (SCL). These lines can be used on 3.3V or 5.0V level with a clock frequency of 100 kHz. For the detailed specifications of this I²C communication refer to the Sensirion "User Manual I²C-Mode SF04".

4 Electrical and Mechanical Specifications

4.1 Electrical Specifications

Table 2: DC Characteristics.

Parameter	Conditions	Min.	Typ.	Max.	Units
Power Supply DC, VDD	for digital out I ² C type	3.5	7.0	12 ^a	V
Operating Current	V _{DD} = 3.5 V, no load		6.8		mA
	V _{DD} = 12 V, no load		6.8		mA

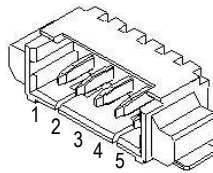
Table 3: I²C Output Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
I ² C Bus Clock Frequency			100		kHz
Output Voltage Low (SDA/SCL)	I _{sink} = 6mA		0.1	0.5	V
Low Level Output Current(SDA/SCL)				6	mA
High Level Input Voltage (SDA/SCL)		2.0			V
Low Level Input Voltage (SDA/SCL)				1.0	V

4.2 Electrical Connector and Pinout

Connector Type: 5 pin Molex PCB Header 53261-0590 (right angle) . Assembled flat ribbon cable Molex 1.25 mm Pitch Rectacle Type 51021-0500 (PicoBlade™ 51021) included.

Pin	
1	SDA (bi-directional)
2	SCL
3	VDD
4	GND
5	Do not connect



4.3 Electrical Connection for Digital Communication via I²C

Digital communication between LG16-2000HC-D type sensors and an I²C master works on both 5V or 3.3V level. The SDA and SCL lines need to be connected via pull-up resistors with the bus voltage of the system. The individual I²C address of each sensor on the I²C bus can be set with a special interface tool.

^a Keep supply voltage below 9V for high precision applications; exceeding 12V will lead to permanent damage of the sensor

4.4 Mechanical Specifications and Pressure Rating

Inside the LG16 flow sensors a highly sensitive microsensor-chip is mounted on the outside of a straight glass capillary and allows to measure the flow through the wall (US Patent 6,813,944 B2) using a thermal principle.

Table 4: Mechanical Specifications and Pressure Rating

Parameter	LG16-2000HC-D
Fluid Connector Ports (Fittings)	¼-28 for 1/16" or 1/8" OD plastic tubing
Wetted Materials:	
<ul style="list-style-type: none"> Internal Sensor Capillary Material 	Borosilicate Glass 3.3 (Duran®)
<ul style="list-style-type: none"> Fitting Material 	100% PEEK™ (polyetheretherketone)
<ul style="list-style-type: none"> Additional Sealing Material 	ETFE(Tefzel®)
Overpressure Resistance	3 bar 40 psi
Maximum Pressure Drop (at max. flow rate)	1 mbar
Internal Sensor Capillary, Inner Diameter	1.8 mm
Total Internal Volume	<90 µl
Total Mass	6 g

4.5 Installation Advice for LG16 Flow Sensors

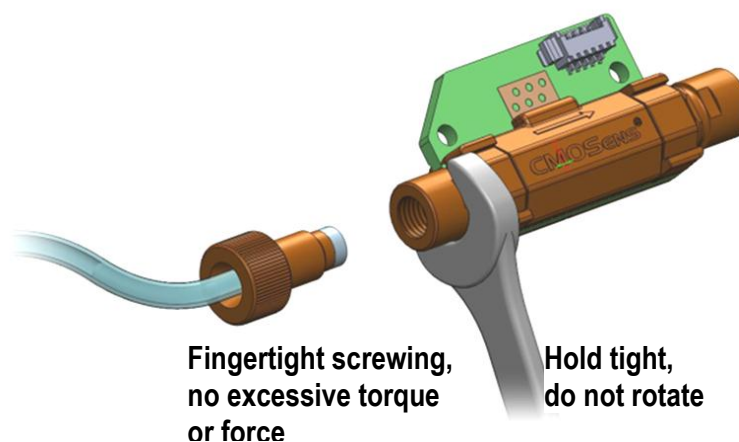
LG16 OEM Flow Sensors are highly sensitive measurement devices for ultra low flow rates. To assure precise and drift-free flow measurements **mechanical stress needs to be avoided**.

These OEM sensors are not made for stand alone usage. You should choose a protected location for reliable operation.

The model LG16-2000 needs to be handled and installed with special care!

Please make sure the following guidelines get respected:

- Connect the sensor to flexible tubings only. Rigid tubings cause mechanical stress.
- **While tightening the fitting, fix the fluidic ports position with a wrench.**

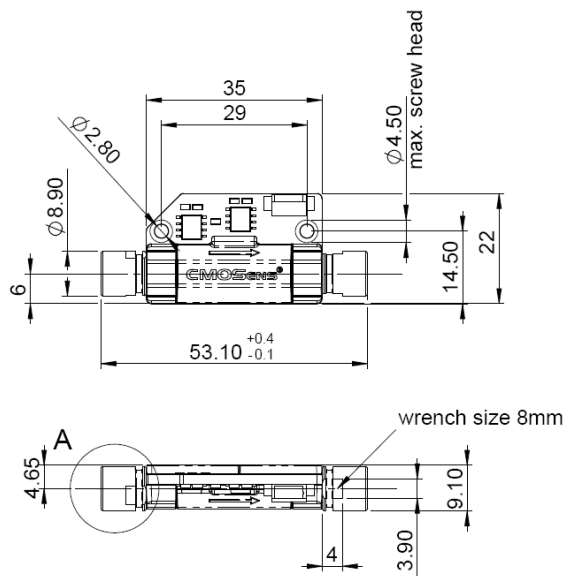


- LG16 sensors are equipped with fingertight fittings. Torques larger than fingertight are not needed for a tight connection and have to be avoided.

- Assure that the sensor gets not stressed temporarily or permanently by mechanical forces like bending or torque.
- The cable length for digital I²C communication should be limited to 30 cm (12 inch)

Attention Fragile	
Mechanical shocks and connecting to the fittings without suitable tools leads to stress on the internal thin walled glass capillary and can cause it to break. <ul style="list-style-type: none"> • While tightening the fittings, fix the fluidic ports position with a wrench. • Test for leakage after every time new connections are made. 	!

5 Physical Dimensions



6 Ordering Information

Fluid connection material is not included.

Product	Article Number
LG16-2000HC-D	1-100840-01

7 Important Notices

7.1 Warning, personal injury

Do not use this product as safety or emergency stop devices or in any other application where failure of the product could result in personal injury. Do not use this product for applications other than its intended and authorized use. Before installing, handling, using or servicing this product, please consult the data sheet and application notes. Failure to comply with these instructions could result in death or serious injury.

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associated with such unintended or unauthorized use, even if SENSIRION shall be allegedly negligent with respect to the design or the manufacture of the product.

7.2 ESD Precautions

The inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation, take customary and statutory ESD precautions when handling this product. See application note "ESD, Latchup and EMC" for more information.

7.3 Warranty

SENSIRION warrants solely to the original purchaser of this product for a period of 12 months (one year) from the date of delivery that this product shall be of the quality, material and workmanship defined in SENSIRION's published specifications of the product. Within such period, if proven to be defective, SENSIRION shall repair and/or replace this

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7.4 RoHS and WEEE Statement

The LG16 product family complies with requirements of the following directives:

EU Directive 2002/96/EC on waste electrical and electronic equipment(WEEE), OJ13.02.2003; esp. its Article 6 (1) with Annex II.

EU Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS), OJ 13.02.2003; esp. its Article 4.



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